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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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EXAMINER

ART UNIT	PAPER NUMBER
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DATE MAILED: D

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

<b>Office Action Summary</b>	Application No. <b>09/298,064</b>	Applicant(s) <b>Xing et al</b>
	Examiner <b>Rudy Zervigon</b>	Group Art Unit <b>1763</b>

Responsive to communication(s) filed on Aug 29, 2000

This action is **FINAL**.

Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle* 35 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

#### Disposition of Claim

Claim(s) 1-7 and 17-20 is/are pending in the application

Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration

Claim(s) \_\_\_\_\_ is/are allowed.

Claim(s) 1-7 and 17-20 is/are rejected.

Claim(s) \_\_\_\_\_ is/are objected to.

Claims \_\_\_\_\_ are subject to restriction or election requirement.

#### Application Papers

See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.

The proposed drawing correction, filed on \_\_\_\_\_ is  approved  disapproved.

The specification is objected to by the Examiner.

The oath or declaration is objected to by the Examiner.

#### Priority under 35 U.S.C. § 119

Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

All  Some\*  None of the CERTIFIED copies of the priority documents have been received.

received in Application No. (Series Code/Serial Number) \_\_\_\_\_.

received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_.

Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

#### Attachment(s)

Notice of References Cited, PTO-892

Information Disclosure Statement(s), PTO-1449, Paper No(s) 4

Interview Summary, PTO-413

Notice of Draftsperson's Patent Drawing Review, PTO-948

Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

**DETAILED ACTION**

***Election/Restriction***

1. Applicant's election of claims 1-6, 17-20 in Paper No. 6 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

***Specification***

2. An examination of this application reveals that it includes terminology which is so different from that which is generally accepted in the art to which this invention pertains that it is impractical to make an accurate search of the prior art. For example: Reference to "...process conversion step..." is not generally supported in the field of the applicant's endeavor.

Applicant is required to provide a clarification of these matters or correlation with art-accepted terminology so that a proper comparison with the prior art can be made. Applicant should be careful not to introduce any new matter into the disclosure (i.e., matter which is not supported by the disclosure as originally filed).

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-7, 17-20 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Reference to “..process conversion step..” is not supported anywhere in the specification. The only suggestions for the type of plasma processing of the substrate discussed in the specification center on “..produce distinct layers...” (Page 10, second paragraph), “...gases are caused to react at or near the substrate...” (Page 26, second paragraph), “..one oxidation process...” (Page 26, last two lines), “..plasma radicals react or interact...” (Page 28, second paragraph), “..nitrogen dielectric material formed on...” (Page 30, second paragraph), “...nitridation reaction...” (Page 31, third paragraph).

***Claim Rejections - 35 USC § 102***

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
6. Claims 1-4, 6, 7 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by P. J. Matsuo et al<sup>1</sup>. P. J. Matsuo et al identically describe a plasma semiconductor processing apparatus that generates a microwave plasma remotely relative to the substrate's location (Section I, Introduction; Figure 1). Additionally, the variable length of the plasma delivery tube is assessed under numerous conditions such as etch rates (Section III.A.2, p.1803), reaction layer thickness (Section III.C.4, p.1809), atomic (neutral) and reactive (radical) species concentration (Section IV.B, p.1812). Specifically, and to further illustrate the teachings of P. J. Matsuo et al, the researchers describe:
  - i. a first reaction chamber ("downstream tubing/lining", Figure 1)
  - ii. a gas source (fluoromethane, oxygen, nitrogen, Figure 1) coupled to the first reaction chamber to supply a nitrogen gas to the first reaction chamber
  - iii. an excitation energy source ("applicator, 2.45GHz", Figure 1) coupled to the first reaction chamber to generate a nitrogen plasma comprising ions and radicals from the nitrogen gas
  - iv. a second reaction chamber ("processing chamber", Fig.1) adapted to house a substrate at a site in the second reaction chamber
  - v. wherein the first reaction chamber is coupled to the second reaction chamber and separated from the substrate site by a distance equivalent to the lifetime of the ions (Figure 4) at a

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<sup>1</sup>J.Vac.Sci.Technol. A 15(4), Jul/Aug 1997

plasma generation rate such that the radicals react with the substrate in a process conversion step (film deposition, Refer to Figure 10(d) and section C.1 - "At point (d) N<sub>2</sub> is injected once more and the reaction layer thickness increases again.")

- vi. the excitation energy source supplies energy having a microwave frequency to generate a plasma from the nitrogen gas (abstract, first sentence)
- vii. The dimensions of the first reaction chamber ("...as the distance from the plasma to the etching region is increased...") are configured such that substantially all of the ions generated by the nitrogen plasma are changed from an ionic state to a charge neutral state within the first reaction chamber (Section IV.B, p.1812)
- viii. An apparatus (Figure 1) for exposing a substrate to plasma, comprising a first reaction chamber ("downstream tubing/lining", Figure 1)
- ix. means for supplying a nitrogen gas (fluoromethane, oxygen, nitrogen, Figure 1) to the first reaction chamber
- x. means for generating a plasma from the nitrogen gas ("applicator, 2.45GHz", Figure 1)
- xi. the plasma comprising ions and radicals (definition of plasma)
- xii. a second reaction chamber ("processing chamber", Fig.1) having means for housing a substrate
- xiii. means for providing the plasma to the second reaction chamber substantially free of ions such that the radicals react with a substrate in a process conversion step (Section IV.B, p.1812)

Item 6.v. is implicitly taught according to Figure 4. As shown in Figure 4, there are non-zero etch rates up to 125cm of first reaction chamber lengths. As such, lifetime of the ions, up to and including these distances, are sufficiently long enough so “that the radicals react with the substrate in a process conversion step”.

7. Claims 17-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Mehrdad M. Moslehi (U.S.Pat. 5,082,517). Mehrdad M. Moslehi identically describe a plasma semiconductor processing apparatus that generates a microwave plasma remotely relative to the substrate’s location (column 1, lines 5-15). The control of the composition of neutral and reactive species, and it’s importance to plasma processing, is taught by Mehrdad M. Moslehi (column 1, lines 46-68; column 2, lines 37-42; column 4, lines 9-14; column 12, lines 56-68). Specifically, Mehrdad M. Moslehi describes a process conversion (column 4, lines 55-60) system where:

- xiv. A system (Figure 1) for reacting a plasma with a substrate
- xv. a first chamber (20, Figure 1)
- xvi. a gas source (12, Figure 1) coupled to the first chamber comprising
- xvii. constituents (12, Figure 1) adapted to react with a substrate (48, Figure 1)
- xviii. an energy source coupled to the first chamber (38)
- xix. a second chamber (24) configured to house a substrate for processing

- xx. a system controller (40) configured to control the introduction of a gas from the gas source into the first chamber and to control the introduction of an energy from the energy source (column 5, lines 43-52)
- xxi. a memory coupled to the controller comprising a computer readable medium having a computer-readable program embodied therein for directing operation of the system (implicit; column 5, lines 43-52), the computer readable program comprising:
- xxii. instructions for controlling the gas source and the energy source (column 5, lines 43-52) to convert a portion of a gas supplied by the gas source into a plasma comprising plasma ions and radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) and to deliver the plasma to the second chamber substantially (column 4, lines 9-14; column 11, lines 54-63; column 1, lines 46-52) free of ions to react with a substrate in the second chamber in a process conversion step

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over P. J. Matsuo et al<sup>2</sup> as applied to claims 1-4, 6, and 7 above, and further in view of Yamazaki et al (U.S. Pat. 6,130,118). P. J. Matsuo et al identically describe a plasma semiconductor processing apparatus that generates a microwave plasma remotely relative to the substrate's location (Section I, Introduction; Figure 1). However, P. J. Matsuo et al does not describe a rapid thermal processing chamber as a second chamber.

Yamazaki et al describes a plasma reaction apparatus for film deposition (column2, lines 20-25). Specifically, Yamazaki et al describes a substrate housing rapid thermal processing (RTP) chamber (104, Figure 4; column 6, lines 9-15).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the P. J. Matsuo et al second reaction chamber for the Yamazaki et al substrate housing rapid thermal processing (RTP) chamber.

Motivation for substituting the P. J. Matsuo et al second reaction chamber for the Yamazaki et al substrate housing rapid thermal processing (RTP) chamber is drawn to the enhanced insulation and thermal conductivity of prepared films (column 6, lines 57-59).

*Response to Arguments*

10. Applicant's arguments with respect to claims 1-6, 17-20 have been considered but are moot in view of the new grounds of rejection.

11. With regards to responses where "Matsuo does not teach" the claim 1 limitations, Applicant is directed to the claim rejection above.

12. With regards to responses where "Matsuo does not teach a conversion step", Applicant is directed to the following guidance:

MPEP - 2114

Apparatus and Article Claims - Functional Language [R - 1]

APPARATUS CLAIMS MUST BE STRUCTURALLY DISTINGUISHABLE FROM THE PRIOR  
ART

Art Unit: 1763

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danley*, 120 USPQ 528, 531 (CCPA 1959). "Apparatus claims cover what a device is, not what a device does ."(emphasis in original) *Hewlett - Packard Co . v. Bausch & Lomb Inc .*, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Additionally, with regards to responses where "Matsuo does not teach a conversion step", ie. "...the conversion of nitrogen into a plasma..."(response second paragraph, last sentence) Applicant is directed to the body of the claim rejection stated above.

13. With regards to responses where "Matsuo does not describe the dimensions of a remote chamber configured that substantially all of the ions generated by the nitrogen plasma are changed from an ionic state to a charge neutral state within the remote chamber.", Applicant is directed to the claim rejection above.

14. With regards to responses where "Matsuo does not describe an apparatus including means for providing the plasma to the second reaction chamber substantially free of ions such that the radicals react with a substrate in a process conversion step ", Applicant is directed to the claim rejections above.

15. With regards to responses where "Moslehi does not describe a system controller configured to control the introduction of a gas from the gas source into the first chamber and to control the introduction of an energy from the energy source, a memory coupled to the controller comprising a computer readable medium having a computer-readable program embodied therein for directing

operation of the system, and instructions for controlling the gas source and the energy source to convert a portion of a gas supplied by the gas source into a plasma comprising plasma ions and radicals, and to deliver the plasma to the second chamber substantially free of ions to react with a substrate in the second chamber in a process conversion step", Applicant is directed to the claim rejections above.

16. With regards to responses where "Moslehi not addressing nitrogen..", applicant is again referred to the body of the claim 17 rejection.

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***Conclusion***

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

*[Signature]*  
**GREGORY MILLS**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 1700**